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SOLE Meets MOOC: Designing Infrastructure for Online Self-Organised Learning with a Social Mission

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ABSTRACT

We present the design, deployment and evaluation of three configurations of an online learning activity for would-be social innovators and activists, with the aim of understanding the factors that are critical to the design of an infrastructure to support such communities of learners. Our research was inspired and motivated by the example of SOLEs (self-organised learning environments) and builds upon the experiences of early connectivist MOOCs (massive open online courses). Our configurations were used to deliver three pilot courses on the topic of Sustainable Development, in partnership with United World Colleges (an organisation of international schools). Our work is distinctive in putting a focus on civic engagement and the autonomy of student learners throughout the course. Our primary design goals were to enable activist empowerment, self-organized learning, and the creation of social bonds to facilitate a lasting and self-sufficient international activist community. We base our analysis on a sample of 114 active learners and 33 mentors; including data from 223 applications, 705 Facebook posts, 48 participant survey responses and a variety of quantitative metrics.

Author Keywords

Online learning, civic engagement, civic education, activism, MOOC, e-learning, SOLE

ACM Classification Keywords

K.3.1 Computers and Education: Computer Uses in Education—*collaborative learning*

INTRODUCTION

Sugata Mitra's "hole in the wall" experiment explored whether children could learn effectively when exposed to technology and allowed to follow their natural curiosity [38]. Mitra's idea of self-organised learning environments (SOLEs) postulates that when learners are empowered to take responsibility for their learning and are given access to technology, they will learn at least as effectively as in

formal school environments. One motivation of our research was to explore and apply this learner-agency based model where learners actively construct and even co-create knowledge during the learning process. Industrial-scale education, already foreseen by Fuller in 1962 [12], has become a reality with near-ubiquitous Internet access and as new models of MOOCs were developed and popularised in the first decade of the new millennium, primarily by universities: first with MOOCs inspired by connectivist theories of learning, then with behavioural cognitivist inspired MOOCs (that place a stronger emphasis on learning analytics and assessment).

Recently, non-governmental organisations have also been exploring the use of MOOCs; for example, Amnesty International conducted its first online course on edX in November 2015, recognizing the potential for raising awareness among learners and enabling their engagement as activists. To date, the generation of social impact through online learning has mostly been considered from the point of view of enabling access to citizens of developing world countries to high-quality, low-cost education (offered by the world's top providers).

The topic of activism itself, and the process of organising the work and efforts of volunteers online, has received significant attention in literature. Much work has focused on understanding the role of social media in creating political movements [16], on specific examples such as Occupy Wall Street [23] or the Arab Spring [22,24], and the potential of digital civic education to drive offline impact. Other familiar areas of concern include the coordination of crowdsourced work in online activist communities – with the creation of online encyclopaedias, including both successful [10] and unsuccessful implementations [33].

While both activism (including digital youth civic education) and online learning have been thoroughly researched, little attention has been paid to the transformational potential of online education design that combines the principles of developing and supporting communities of practice with the scale and diversity of MOOC-scale learning. The contribution of this work is twofold: (1) to show the potential of online courses as a way to facilitate creation of online learning communities for social innovation and activism; (2) to establish a set of best practices, based on our three design configurations, for



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infrastructures to support collaborative learning communities of would-be social innovators and activists. Our work is inspired by SOLE principles and builds upon best practices of connectivist MOOCs addressing many of their known challenges. We use the term ‘infrastructure’ here instead of the term ‘platform’, conventionally used in education technology research, in order to highlight the importance of the entire suite of internet tools and organizational processes that are normally used in preparing and running an online course, including the course website, any social media presence as well as the structure of communication between course organisers and learners.

RELATED WORK

A vast body of existing research has focused on understanding the learning process, motivations and outcomes of MOOCs. A further body of research also considers the topic of the development of online communities and coordinating online activism. However, the question of how using online education can support social change goals, through the development of communities of social innovators and activists, has not yet been widely explored.

Activism, communities of practice, online communities

Online activism encompasses a variety of online activities, including awareness/advocacy, organisation/mobilisation and action/reaction [34] and much of the existing research base addresses the role of social media in driving awareness about issues and the mobilisation of populations to act in response to these issues.

Role of social media

A primary focus of digital activism research is the role of technology and social media in creating political movements [16], particularly developing an understanding of how activist organisations can drive offline action in offline communities [17]. For example, a number of studies explored the dynamics of the role of social media in shaping political debates (reinforced by the absence of free media), affecting events on the ground and spreading democratic ideas across national borders during the Arab Spring [22,24]. Other work has shown the importance of social media for spreading political ideas as well as the importance of assuring the sustainability of movements such as Occupy Wall Street by decentralisation [23].

Analysis of youth online civic engagement revealed the changing nature of citizenship in the digital age – from *dutiful citizen* (who sees voting as a core responsibility of a citizen) to an *actualising citizen* (who typically distrusts government and does not view voting as core citizen responsibility, and instead focuses on the importance of loosely networked community actions). Several online communities exist which aim to empower young people to learn about volunteering opportunities and how to make an impact in their communities (DoSomething.org, PublicLab.org) or programs organised by leading global educational institutions (such as MIT's Center for Civic Media and Harvard's Berkman Center). Other approaches

seek to promote young activist role models through their fellowship programmes, such as Global Youth Connect. Studies of activist website design [31] highlight that such sites do not focus on course-based education, but instead offer self-guided asynchronous access to educational and promotional materials.

Online communities

The literature on communities of practice has explored learning in a much wider sense as situated in the process of legitimate peripheral participation [30]. Wenger's later work on learning, meaning and identity creation further explored the dynamics of this interaction [53].

The most researched online community is Wikipedia, which has been analysed from several points of view as knowledge crowdsourcing experiment [11,51], as an example of an altruistic community [29] and as a social movement [28]. Significant effort has been devoted into understanding how successful online communities emerge and are sustained [42,43], including structural features [18]. A number of best practices have been broadly established, including: designing for sociability (in terms of community members' roles and responsibilities, codes of conduct, expectations) and usability (ease of use for novices and experienced users alike) [42]; building communities focused on design principles to achieve group identity and group cohesiveness; and reinforcing the “mission”. In relation to online activists communities, the definition of a sense of ‘we’ and others has also been seen to be a key element of vibrancy and sustainability [42].

Ultimately, our research is motivated by the fact that while there is a robust framework for the design of online communities, and the nature of MOOC-based learning and communities is a topic of active exploration, the problem of designing online learning for social innovators and activists is largely underexplored.

MOOCs and SOLEs

The term MOOC was introduced in 2008 by David Comier to describe open access large-scale online courses, inspired at that time by the connectivist theory of learning introduced in 2004 by Siemens [47]. Today, the term MOOC is used to describe a vast variety of course offerings made by a plethora of organisers ranging from newly created EdTech start-ups to well-established universities.

Connectivism and cMOOCs

Connectivism was proposed by George Siemens as a new theory explaining learning which happens in a world where people are connected to each other and resources via technology [47,48,49]. Connectivism explains knowledge as a set of connections that are formed either in mind or in a society, and that form a network, which adapts as experiences are built [9]. Learning is described as a nonlinear process whereby learners tap into the knowledge network [47]. The key features of connectivist MOOCs (cMOOCs) are autonomy (learner's choice of learning pathways and materials to be studied), diversity (of learners

in a course), openness (understood as open access) and connectedness/interactivity (the processes which enable learning) [32]. Engagement and learning motivation were the key questions considered in the scholarship about these first MOOCs [25,50]. Other research investigated designing the learning environment to allow for transformative learning to take place [27] and which of the several off-the-shelf online applications were preferred by learners [26]. Several vocal critiques rejected connectivism as a learning theory [4] and then as a “naive and damaging blip in the educational media’s long and carefully grounded history” [2].

Behavioural cognitivism and xMOOCs

cMOOCs inspired the second wave of courses (xMOOCs) which stood in contrast in both pedagogy and philosophical foundation. The scale of courses increased, with some reaching more than 100,000 registered students. This new generation of xMOOCs were inspired by behavioural cognitivism, and focused on the acquisition of information pre-defined in a linear curriculum, communicated to learners by means of online videos and articles, and assessed through online quizzes and automatically- or peer-reviewed assignments. Where in cMOOCs knowledge was generative, in xMOOCs it was declarative [45]. Furthermore, in xMOOCs the relationship between teacher and students is limited, and the knowledge is “transmitted” to students. Interaction in xMOOCs is mediated by (mostly) proprietary platforms, with course content typically protected by restrictive licenses that do not allow sharing [45].

Scholarly discourse on xMOOCs focuses on learning analytics (learners’ unique learning paths through course content in a constrained and predefined platform environment), optimisation of user experience to minimise attrition, and assessment (in the context of MOOCs as substitute for brick-and-mortar based delivery) [46]. The lack of innovation in MOOC pedagogy is the predominant axis of critique, with MOOCs’ unidirectional structure seen as failing to capture the transformational potential of education [44].

Supporting online collaborative learning

Since 2013 (‘the year of the MOOC’) the landscape of MOOCs has seen innovation in approaches to tackle the challenge of learner engagement, assessment and feedback. New takes on developing online interactions between learners and course organisers included DOCCs (distributed online collaborative courses), BOOCs (big open online courses), SMOCs (synchronous massive online courses), SPOCs (small private online courses) and corporate MOOCs [5]. In particular, recent experiments with SPOCs have shown promise. In March 2014 Harvard Business School launched HBX, a proprietary platform for executive business courses that demonstrated high engagement of learners in the course (by facilitating more interaction between students and organisers) [19]. Other edX courses have demonstrated a positive improvement on the quality of

student assignment quality when a smaller group (132 students) is given assistance from a higher number (15) of teaching fellows [13]. Similar positive experiences in terms of student engagement and higher quality instruction were noted also in Harvard’s CopyrightX course, where a pre-selected group of students engaged in group discussion, managed by a group of TFs, using videoconferencing [13].

Self-organisation in learning

SOLEs originated through Sugata Mitra’s early research into unsupervised learning using computers [38]. Mitra points to self-organisation originating as a physics term, describing a system which exhibits an emerging behaviour via local interactions but without centralised control, which in its application to education Mitra calls “learning at the edge of chaos” [35]. The Internet allows for children to explore a variety of resources, many created with adults in mind, to decode meaning and answer big questions while working in small groups [35].

The earliest experiments of Mitra describe the learning that took place when young children, with no computer literacy are given access to computers – they learn to use the different functionalities, discover various programs and teach one another about their discoveries [36,37,38]. Later work included different configurations of these experiments [8,39]. The authors were inspired by this learner oriented, connectivity (to Internet and others) driven approach to learning and wanted to see what elements of the SOLE methods can be adapted to run a large scale online course that empowers a community of young activists.

DESIGN GOALS

Our goal was to establish the characteristics of an infrastructure to support online learning for would-be activists through the design, deployment and evaluation of actual courses. Our work in part returned to many of the ideas of cMOOCs (peer-to-peer interaction, diversity and high levels of learner autonomy), but also includes structural elements of successful online communities. This required us to address the inadequacies of existing platforms for building activist learning communities: both online learning platforms and targeted civic education social platforms.

However, although inspired by cMOOCs, which operated without a formal learning management system, we decided against this approach in its purest form (given some cMOOC learners’ reports of chaotic experiences and feelings of being overwhelmed [26, 27, 32]) and instead included elements of structure that we believed would appeal to our younger, less experienced, learners. On the other hand, we did not want to use an LMS inspired by behaviourist approaches to education (such as Coursera) and while alternative LMSs, such as Moodle (see also Blackboard, Piazza, etc.), place some emphasis on user generated content and provide support for the creation of communities of practice (through its social features such as forums), we were concerned that student engagement and

the creation of lasting social connections would be made difficult if we fully relied on custom infrastructure.

Given that our work is informed by connectivist and learner-agency and community-based theories, and the potential of integrating social media in education has been shown by several research studies [5,15], we instead utilised a custom designed website and a range of existing social media applications and utilities (Facebook, Google+, YouTube, Twitter, etc.). Task design included course materials such as syllabus, training materials for course organisers, mentors, learners, communication templates, etc. Additional design considerations concerned the methodology of learning and teaching, selection of interaction modes with expert lecturers, structure of weekly discussion sessions and type of assignments to be given out.

The online learning infrastructure had to respond to several design objectives: (1) to empower learners to begin their own social mission driven initiatives (with the support of the created learning community and through careful scaffolding); (2) to enable learners to get to know one another and share their unique experiences (through asynchronous communication via messaging and social media and synchronous discussion in small groups); and (3) to facilitate self-organisation of learners, who are both able to effectively follow unique learning paths and effectively follow course schedules and materials in an easy-to-use way both synchronously and asynchronously (videos, articles, content created and shared by others). Our approach was specifically tailored to the needs of people with high levels of self-efficacy and digital literacy.

ONLINE UWC: FROM IDEA TO IMPLEMENTATION

We ran three cycles of design, deployment and evaluation through three configurations of an extracurricular online course focused on the topic of sustainable development. The young learners (14-20 year-olds) were pre-selected based on their written applications. We gathered participant applications and participant and mentor feedback for each edition of the course, as well as a set of quantitative metrics such as group sessions participation or live and on-demand views of video lectures.

We changed and improved some elements of course design in each edition to compare results in the final stage. The goal of the first edition was to test the learning approach with a small pilot group of 10 learners before rolling out to a larger audience. The second edition focused specifically on learner engagement and mastering logistics by working with 86 learners in three different time zones (London, Hong Kong and New York). The third edition had 18 learners and focused on understanding the scaffolding process for projects and the role of mentors in the success of future courses. We conducted a detailed analysis at the end of each edition to provide grounds for design recommendations with the aim to establish which design elements help facilitate activism through collaborative

learning while allowing the learners to have more control over their own learning.

The First Edition

The initial Online UWC infrastructure design was guided by theoretical best practices presented in online education literature [1,3,14,24,25]. We used Google Course Builder to build the website and present course schedule and materials given the simplicity of deployment as well as the ability to heavily customize the website in the future. We included social media communication channels to provide sociability tools for the participants required for the creation of social bonds [42], which were not part of Google Course Builder's design.

The course was designed to support user engagement, inspired by prior research findings [1,3,14,24,25]. Learners had to complete an application form prior to admission for the course as well as commit to paying a small fee, which served to promote commitment to the course [13,40]. Learners unable to pay the fee were asked to apply for financial aid, which was granted if candidates met (lenient) eligibility criteria. A key element of our design was the inclusion of mentors to help run the course whose presence has been shown to encourage higher level of engagement in online courses [40]. Our mentors were aged 15-30 and came from a variety of backgrounds (business, academia, NGOs) and were all alumni of United World Colleges. The main role of mentors was to be the point of contact for learners: troubleshoot technical difficulties, clarify any confusion about the course schedule, communicate via email, the website and on the Facebook group [7].

Additionally, the application process, which was open to candidates from all over the world, helped to assure that the admitted candidates shared a set of common values, a condition that helps create effective online communities [42] and had a basic working knowledge of English. What the learners, mentors and experts had in common was their passion for building a more peaceful and sustainable world.

The course design introduced enough structure to keep the learners oriented, while offering enough flexibility to help them negotiate their learning objectives, problem-solve and explore different areas of knowledge in real life conditions (as per SOLEs). The course schedule (including a communications calendar) followed a simple weekly structure (see Table 1) in order to help orient the learners, as recommended by previous research [14]. Learners were given their weekly assignments on Sunday, which typically consisted of links to assigned videos and readings (newspaper articles, TED talks). Each Wednesday, an expert lecturer would talk about the week's sustainability topic (via Hangout on Air, later shared on a YouTube channel). On Thursday, the learners took turns in chairing or facilitating a discussion on the week's topic. The weekly chairs received a short briefing over email to propose some ideas or structure that they should use in this learner-led discussion class. Learners were then given assignments to

be completed by the following week (often in pairs or small groups).

Metric	When	Scale	SO*
Weekly email	Sun/Mon	All	No
Hangout on Air	Tue/Wed	All	Yes
Hangout	Thu	3-10	Yes
Assignment	Fri	All	Yes
Big FB group	Continuous	All	Yes
Small FB group	Continuous	3-10	Yes

Table 1. Approximate course schedule and interaction modes.
*SO qualified whether or not task type included elements of self-organization.

We designed learning tasks to resemble the work of activists (e.g. working together in small groups to create written, rich media and video materials, discussions about means to solve environmental issues). Learners were challenged with real-world problems, which were relevant to their communities. We aimed to ensure that learners knew that they were not expected to hand in a traditional “paper” as a response to assignment prompts, but an output in a format of their own choosing, such as audio files, videos, animations, drawings, PowerPoint presentations, Prezis etc. Thus their imagination and technical skills were the only limit for how they chose to work together and present their results. Additionally, we emphasised the importance of experts having activist background, to serve as role models for the learners. The experts were sustainable development practitioners (activists, entrepreneurs, academics, etc.). They presented their career experiences as well as an overview of the topic grounded in their own experience during the weekly expert Hangouts.

Throughout the course learners were encouraged as much as possible to become course co-creators, to both increase their own sense of self-sufficiency, and to meet the design goal of self-organisation. Learners were encouraged to find more materials that were relevant to the topic of the week and share them with others. They interacted with lecturers and classmates live through Google Hangouts, and synchronously/asynchronously on Facebook, voted on the topics they most wanted to study, recommended and invited guest lecturers they found exciting, and were continuously challenged to co-create the curriculum through discussion with their classmates and the organisers.

Evaluation of the first course

Ahead of the second course, we conducted two rounds of feedback (one mid- and one post-first course) to enquire about learners’ satisfaction with the model provided and to establish which design elements should be further explored in the second course configuration. Learners reported enjoying communicating with others in different countries and wished for even more opportunities to make personal connections. Out of 6 responses in the end-of-course survey, 1 learner said that the course did not give them the opportunity to meet others, and even of the 4 learners who answered “Yes, but...” hoped for more opportunities to get

to know each other: “*I thought we could use more time getting to know each other. There are students I never got to know.*” (C1R5)

Additionally, based on feedback questionnaires, several students were confused about the different modes of communication and were not clear about using the technology needed to participate in the course (6 out of 11 responses to question about improvement ideas mention learner confusion).

We also started accepting applications for the next course, which gave us more insight into student motivation. Based on a review of applications for the second course, we established that making a difference in communities was a primary driver for participation: 55 of the 189 approved explicitly mentioned themes relating to concern for their communities (local:27 and global:28), for example as participant C2S150¹ explained: “*I would like to learn more about sustainability because it is a way to make the world better, not just being worried about the social, climate and economic problems: learning about sustainability gives you instruments to use in your city, country and all over the world in order to take care of the planet and making it last for future generations.*”

The Second Edition

Recognising the importance of community impact to applicants, we refocused the second edition around community projects – students were asked to consider ideas from the first week and were guided into implementation of their ideas throughout the course. Ahead of the October course, a new website was set up. In the first edition of the course we did not have a formal scaffolding process to create and discuss projects. Consequently, no community projects had been created in the course. The key feature of the new website was that it allowed users to create user profiles and set up projects. Students could share links to their projects, share them on Facebook, and like, follow and comment on their peers’ projects.

We addressed the need to strengthen bonds between students by reinforcing the sense of community. For example, we implemented a suggestion offered by C1S4: “*I would suggest you to make people write a brief presentation including not just why do participate in course... But whatever they want to share and send the presentations to all participants before the course starts, it could help to know a bit more one other.*” We used the first task as an opportunity to present oneself in the Facebook group and gave an example with custom creative videos we made. We also made sure that everyone had a chance to introduce themselves and felt comfortable in an online Hangout before diving into the class content (a message that was reinforced both through mentor training and

¹ For CxSy: “x” is the course edition, “Sy” a student; CxMy: “My” a mentor, and CxSMMy: “SMMy” is a student mentor.

student chair briefing notes). We also provided more structure to welcome newcomers in a prominent space on our new course website to ensure that learners, used to a traditional learning structure, would not be surprised by self-organised elements of the course.

Ahead of the course we also sought to create a community of mentors through repeated communications by emails and Hangouts, in which best practices were shared as well as help solicited in course material creation. We also gave the opportunity for one alumnus of the first course (familiar with its methods) to become the first student-mentor, and to investigate learner attachment to mentors we swapped mentors half way through the course. Finally, we strengthened the structure of the course by clearly defining a communication schedule for the courses, providing a schedule ahead of the courses and empowering mentors as intermediaries between students and course organisers. We had noticed that communication about course logistics took too much of the students' attention in the first course (54% of posts and comments related to discussing logistics).

Evaluation of the second course

Throughout the course 41 projects were set up (for 86 active students). Projects comprised an image, a short description, and next steps needed for implementation (see Figure 1). Students had to create a profile on the course website in order to create new projects, or follow or like other projects. Projects created on the website were generally well thought out and many included user created graphics. Ideas included education-related projects (creating a green contest or Model United Nations club at local school), environment related projects (reducing water usage, creating a recycling project), and social welfare projects (refugee inclusion project, homelessness).

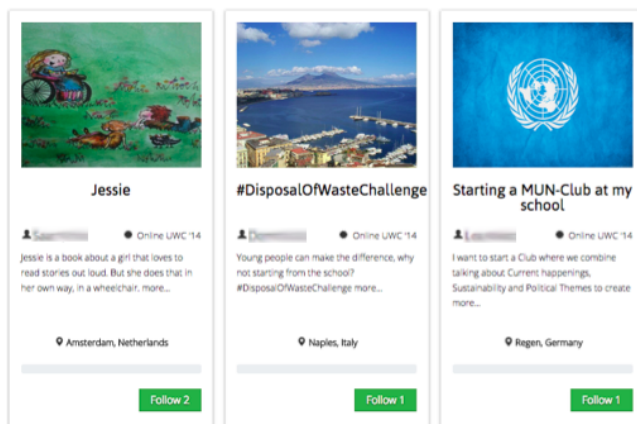


Figure 1. Example student projects set up on course website.

A refreshed, more attractive website paired with a social media marketing campaign resulted in a ten-fold increase in applicants. This larger scale deployment required us to consider design elements necessary to manage a larger user base. The course required significant time investment from course organisers (including administrative tasks such as splitting students and mentors into groups, coordinating

scheduling and setting up calendar invitations for all groups, tracking attendance and assignment completion, answering questions from a much larger number of students etc.). Live lectures had to be organised in three different time zones. The 20 mentors who joined the learning community had to be induced into the community. As course organisers we noticed that the time commitment required to run the course per week almost doubled vs. the first edition.

Mentors helped prepare class materials ahead of the course and they also helped recruit a number of experts, which significantly helped the organising team. The student mentor (C2SM1) who participated in the course enjoyed the experience and did not report specific problems relating to their being an alumnus. Mentors also took on leadership roles as needed: *"In the second session it was the chair having difficulties with the technical part. That is why I had to take over"* (C2M4). Swapping mentors half-way through the course did not have a positive impact on class. As student C2R3 observed: *"Switching mentors was more confusing than 'rewarding'."* Mentor C2M5 confirmed this: *"I don't think changing the mentors was a good idea because we just started building a relationship of trust and fun together that was ended very abruptly."*

Mentors provided feedback about interactions inside the small Hangouts. 13 out of 30 (43%) responses mentioned low attendance as a problem. Mentor C2M5 commented: *"What could be improved is to have a better 'emergency plan' in case only a limited amount of students shows up and the planned discussion is not possible."* Many students could not make it to class because of technical issues: *"We had 14 students assigned, out of which 5 made it. Some were having tech difficulties"* (C2M1). Other groups had the opposite problem: *"The hangouts are only designed for up to 10 people. As we have 14 in the group this meant some people couldn't join."* (C2M4).

Mentor responses shed light on the different sources of technical issues faced by the students, including power shortages in their towns, slow internet connection, social media being blocked at school, and issues with unmuting microphone or unlocking the camera. 68% of mentor responses mentioned the presence of technical difficulties for one or more participant.

The Third Edition

The third edition aimed to explore a simpler interface to set up project ideas (without detailed user profiles or numerous description fields). We also further experimented with the role of the mentor. While in the first edition of the course we had assigned two mentors to each class, in this edition we assigned one mentor to half the groups. Additionally, we increased the number of student mentors: a third of mentors were alumni of previous courses.

Evaluation of the third course

We used a simple Google Slides template to limit friction at project set-up and encouraged students to update their

entries throughout the course. While the overall number of projects per learner increased from 48% to 67%, the number of projects for which completion evidence emerged in the following 12 months decreased from 21% to 17%. The implications of not having mentor back-up became apparent when one of the mentors forgot about his session in the first week of the course, which resulted in several messages on the Facebook group from confused students. Similar events happened the following week (explaining an increase in logistics related posts and comments between the second and third). However, student mentors met expectations and were able to effectively run group sessions. Indeed, they were the only ones who provided feedback after the end of the course. Experiences of this edition highlighted the crucial role that mentors play for the effectiveness of an online community of young learners.

FINDINGS

By reflecting across the three editions of the course we are able to revisit our three primary objectives: (1) empowering students to begin their own social mission driven initiatives (2) enabling students to get to know one another and share their unique experiences; and (3) to facilitate self-organisation of students. Table 2 presents summary statistics for the three editions of the course.

Metric	2014-06	2014-10	2015-03
# Actives	10	86	18
% Graduated	70%	77%	67%
Students / Mentors	3.3	4.3	1.8
WT / Student	58	173	161
Posts / Participant	5.8	6.0	8.1
Projects Set Up	0	41	12
Impact Evidenced	3	18	3

Table 2. Summary statistics for the three editions of the course. Number of active students measured as students who attended at least one group discussion session. Watch Time (WT) denoted in minutes. Impact evidenced calculated as projects in which an individual took part (can be more than one per individual).

Promoting activist involvement

We can consider both the primary and secondary effects of creating this activist community through the three editions of the online course. The primary effect was that students learned about different ways in which they can get involved in their community and created 52 community projects throughout the three editions of the course. In participant surveys 76% of student respondents mentioned that the course helped them think about creating their own project, with the highest proportion (83% in the October 2014 course, and the lowest in the June 2014 course where projects were not emphasised or scaffolded throughout the course). In the feedback respondents clarified that project-focused lectures and feedback from peers in their class showed them the importance of iteration and community research before setting out to build a project (12 of 23 responses mentioned the importance of peers or expert lectures). Additionally, 2 of 23 students who responded

positively mentioned they already had been involved in volunteering projects when they started the course.



Figure 2. Online UWC students present what they learned in the course at their school

Over a period of 12 months following the courses, evidence emerged of at least 24 instances of student involvement in activist endeavours. In the second course, United Youth Journalists projects emerged one month after the course. The initial post by C2S46 (we present its beginning below) shared details of a simple idea, which was discussed and iterated in 58 comments by other group members: *“I had this idea, I know in some ways it already exists but I was thinking about creating a website in English with who is interested in writing articles about his country.”* This eventually led to the creation of a separate online community and consequently, an online magazine that has since published more than 110 articles [52]. What was striking about this example is that the project emerged not as a formal classroom assignment, but as an idea that was floated within the group after the course has ended and happened on the private discussion group. Students wanted to engage as equal partners – did not want help from course organisers – wanted to do their own project, which they would manage on their own. At the same time, this example evidenced the existence of a community that does not cease to exist after the class is over, and the benefit of using Facebook instead of custom software as a means of building and sustaining engagement in the learning community.

The secondary effect was that many of the projects were promoted outside of the direct online classroom and involved the creation of outside learning communities. The example above resulted in the creation of a Facebook page (which at the time of writing has over 3,500 followers) where members share their articles with their friends network, further expanding its reach. Other students provided evidence for conducting presentations about sustainable development issues in their schools (see Figure 2), further increasing the impact of their online participation to real-world communities.

Promoting community

As we adapted design elements to reinforce community building, we saw positive impact both on social aspects of the community and on activist outcomes. The second and third edition of the course, where we put a large emphasis on creating a community of learners (see Figure 3), saw a larger number of posts on the course's Facebook group per student. The second course, which had the highest number of participants, also saw the highest number of comments per participant (15 per student vs. 11 per student in the third edition and 2 in the first edition). As one student explained, getting to know others helped him share ideas: *"We weren't very comfortable around each other at first and it took us a while to actually be more comfortable and have good discussions"* (C2S6).

In the second course, we also observed that students wanted to go to a smaller subset of their group where they found interaction more manageable. When asked about their preferred mode of communication (multiple preferences were allowed), 100% of respondents in the first and third editions of the course (both had less than 20 participants) identified the overall course Facebook group, as compared to only 40% in the second course; 70% identified small discussion groups, 60% Hangouts and 50% email. By contrast, students in the third edition of the course (which was smaller than the second but where creating social connections was reinforced unlike in the first) were the most satisfied with the degree to which they got to know each other throughout the course (3.3 average score out of 4, with first course at 2.8 and second at 3.0).

Moreover, many students mentioned in their feedback that they enjoyed meeting others from different countries; for example: *"It was very interesting to find out new things about other countries. I also realized things about my country that I didn't know before."* (C2R10). Other evidence of the strength of bonds formed was the fact that students were not only meeting in real life when they travelled to other countries, but they also shared these news in photo updates with the rest of the communities.



Figure 3. Example of playful community building during one group Hangout.

Promoting self-organisation

There were two ways in which evidence of self-organisation emerged throughout the courses: participants helping each other solve logistical and communication issues, and sharing external materials (articles, videos, or personal stories) to propose new discussion topics (see Table 3).

Type	2014-06	2014-10	2015-03
Assignments	12%	23%	40%
Relationships	4%	37%	16%
Logistics	54%	13%	27%
Content sharing	17%	12%	8%
Technical issues	7%	7%	8%
Self help	5%	4%	0%
Connection invites	0%	3%	0%
Other projects	1%	1%	1%

Table 3.. Percentage of topics of Facebook private group posts and comments per course edition.

Students self-organised to troubleshoot problems that related to both scheduling and technology. They also came up with ideas to better share course materials: one example from the first edition of the course included a suggestion to write up summary notes for group discussions so that those who were not able to participate can catch up. Taking live notes became a suggestion, which we shared with student chairs in future editions of the course.

Students also shared contact information to get in touch on external platforms (including WhatsApp, Instagram). Many individually connected as friends on Facebook to students, mentors and course organisers. Three posts on the topic elicited 52 responses from others wanting to share their contact details across other social media tools. Students contributed to co-creating course materials in several ways. They shared resources on Facebook and proposed discussion topics (~10% of posts and comments in all courses related to students sharing resources and discussion topics). In the first course one of the students proposed to get in touch with an expert they wanted to meet, approach them to arrange the Hangout (which was rated 4.3 out of 5 by course participants). 73% of the students who responded to the survey enjoyed the group discussion facilitated by the student chair.

Students contributed questions to drive discussion with lecturers (who only spoke for the first 15-20 minutes with the rest of the time devoted to answering student questions). A great example of interactivity in Hangout on Air lecture occurred during a Week 2 Video lecture on the topic of Inclusive Cities, which attracted a total of 40 comments [41]. Several provided feedback to the lecturer in case things were not clear or if Internet connection was intermittent. Students were making connections between the case studies presented by lecturers and their own contexts: *"What would you do for pass the ideas of Curitiba and Waterloo to a big city like Mexico City, for have a really impact considering the population size?"* (C2S142)

or “What do you suggest leaders like Stephen Harper (Canada's prime minister for those of you who don't know) do to act on climate change?” (C2S87). Students also provided live comments or question some of the materials presented by expert lecturers: “We live in a Tropical country! And we don't have sidewalks. Use the bicycle as transportation to distant places is impossible because it's hot out there!” (C2S153).

Mentor survey results showed that 60% of responses about group discussions mentioned that the student chair performance was good: for example “the student chair was very strong” (C2M15), “the student chairing went well” (C2M5). At the same time, it should be noted that only 35% of discussion sessions were chaired by students, due to the small number of students (usually 3 or 4 per discussion session instead of 10 in a group). Mentors also referred to the under-preparation of some student chairs or technical difficulties that they faced, which led to mentors taking over.

As another element of self-organisation, we allowed students to find project partners from other countries and set-up working with them on joint projects. Students in all three courses reported enjoying the experience (81% of students who responded to this survey question), but while students valued the interactions, many voiced concerns and frustration about having to find other active students without the help of the platform (30% of the students who responded). The following response is representative of many students' frustrations: “I don't understand how you expected us to work with students from other regions through the web. I did, but it was complicated to get together, there was a platform missing.” (C2S14)

As course organising processes improved (we launched a full weekly curriculum plan ahead of the March 2015 course) some elements of student organisation decreased but the content sharing element of self-organisation increased. This is evidenced by the fact that participants engaged in longer discussions, with content sharing posts made by students attracting 1 comment each on average in the first edition of the course, 2 in the second edition and 7 in the third. Students also posted longer comments (with some of them as long as 500+ word opinion papers).

DESIGN IMPLICATIONS

Our three editions of the course correspond to three configurations of infrastructure for supporting learning, and in summary demonstrated that it is possible to realise the characteristics we set as objectives using a loosely coupled set of media. However, this became increasingly difficult when the number of participants exceeded 100. In particular, while the social media channels used were clearly valuable for engaging students, they lacked several features necessary to foster community building and early stage project feedback processes. As a result we have identified several implications for the design of a learning infrastructure that will better meet our three objectives.

Logistics and mechanics of activist learning

Learning infrastructure should aim to minimize distractions that do not directly support our design objectives. An important way to enable this is to ensure the seamlessness of the logistics of the course and the mechanics of its operation for course organisers, mentors and students (especially as the scale of the course increases).

Organise the resources

Infrastructure must clearly lay out the rhythm, pacing and expectations of learning activities, as well as allow the students to interact with others, in a space that is dedicated to learning. It must allow the course organisers to drive dynamic communications and social media re-engagement. Infrastructure needs to provide an access point for students to course resources, schedules of key events, and assignments. Key features are likely to include access to the syllabus, recommended resources and links to live video lectures, and ways for students to find each other on social media and submit assignments and project ideas.

Enable creative expression in tasks

The creation of community projects (and any other assignments) should allow students to express themselves creatively, including allowing them to upload and embed pictures and video files. Students should not only have the capacity to like or comment a project, but also to search for projects that are of interest to them. Finally, task design should reinforce the importance of providing feedback.

Automate mundane tasks

From the course organiser's point of view, infrastructure must make it possible to recruit the students into the course, plan course interactions (such as weekly Hangout sessions and expert lectures, assignments and weekly emails), execute course interactions (e.g. send out the weekly reminder emails) and establish participation achievements after the course (e.g. participation and assignment completion data).

Supporting scale and sustainability

Several design components can support scale. Especially the complex task of setting up schedules and reschedules of group sessions needs to be devised for a large-scale deployment (i.e. more than 100 students). Students should be put into groups based on preferred time availability and maximum diversity within a group. Our three deployments, demonstrate the positive impact of mentors on learning, and mechanisms are required for recruiting mentors, both from previous course alumni and separately, ahead of the course. In particular, infrastructure must support the potential for students to transition from the role of student to mentor. Designing for scale also has implications across (as well as within) courses, as infrastructure must allow new organisers to create their own communities and courses, and include commissioning tools to help organisers sample interest before significant resources are devoted to curriculum development.

Focus on learning

The focus of the learning infrastructure should be the organisation of courses, and while it should allow for students to remain part of the community, as alumni and potential future student-mentors or experts, it should encourage members to only use the platform for brainstorming before moving to external platforms (such as custom built websites or Facebook communities) to continue building their projects and stay in touch with others as best suits their respective needs.

Community building and reinforcing community layers

Learning infrastructure should be structured around the community itself, rather than the content, and focus on the development of lasting collaborations between students and enablement of impact through activism.

Layer community engagement

All layers of community engagement are important for effective activist classes. Interaction in larger groups allows for students to get to know others from different countries and feel they are participating in a vibrant and lively community that allows for the spontaneous sharing of ideas and a diversity of perspectives in learner initiated online discussions. At the same time, smaller groups promote more in-depth conversations and give the opportunity to provide higher quality feedback as students become more familiar with each other, and more willing to share their thoughts. A key requirement is that students should be able to easily navigate between the different layers of the community, from big course groups to smaller discussion groups, as well as be able to find and communicate with individual students (e.g. pair up for group projects).

Surface student presence

Allowing students to know who is in their group and be able to connect with them easily is a fundamental requirement. When students can easily identify who else has been active in the course, they can connect with more ease to complete assignments together. When students and mentors know who is planning to attend a group Hangout discussion, they can adjust the schedule if needed ahead of time to ensure the required number of participants is met, and create a new event in the rare case that all 12 participants assigned to the discussion session would plan to attend. The students should also have the opportunity to negotiate the time of their attendance every week to suit their personal circumstances.

Reinforce community leaders

Strong community leaders (mentors, student-chairs) are key enablers of activist learning. Mentors help guide newcomers through the community, help facilitate engaging discussions and escalate more difficult questions to course organisers, but their recruitment and training takes time. The student-chair model works well with groups that have full participation showing potential for engaging learners in leadership roles. Larger scale learning environments will benefit from incorporating design elements that promote such learner leadership.

Self organisation: focus on central skills

Two types of self-organisation during the course were observed: one that was driven by frustration from the inefficiency of tools used, and one that involved students sharing their opinions and thoughts with others.

Tackle technology problems upfront

Technology issues have consistently been an issue for several participants – despite almost ubiquitous access to the Internet, both the connection strength and hardware used for connecting to class materials will likely cause challenges. Learning infrastructure must be capable of coordinating between tools that are familiar to the students (i.e. social media, video conferencing tools). It is also necessary to provide resources for learners to refer to, in the event of problems arising, and to encourage them to set up and test their technology ahead of key activities (e.g. the group Hangout).

Make negotiation of learning a habit

Course organisers should be able to provide a clear structure to a course but also allow students to negotiate the modes of their participation (e.g. by inviting additional expert speakers or submitting assignments on a personally selected topic). While many students and mentors may still choose the default, the platform should readily surface and reward innovation and customisation with a view to inspire others to experiment. Design elements which encourage students to negotiate their learning and actively co-create course content should be implemented.

CONCLUSIONS

Our study involved the design and deployment of three configurations of social media and communication technologies to deliver online learning, followed by the evaluation and analysis of, and reflection on, student and mentor behaviour and outcomes. Our design recommendations comprise several principles for creating infrastructure to support online learning targeted specifically at communities of would-be social innovators and activists. We see widespread application for such activist-oriented learning infrastructure, from NGOs (for many of which education activities are central to their mission) and companies (aiming to increase international knowledge sharing among employees), to traditional educational institutions seeking to re-engage their alumni communities.

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